Wintering Duck Response to Trail Use at Former San Francisco Bay Salt Ponds

Heather R. White | San Jose State University | M.S. Thesis

SFBJV Restoration Committee Meeting | July 14, 2009

Photo by C. Robinson

INTRODUCTION

Research Need:
South Bay Salt Pond Restoration Project

- Second largest tidal wetland restoration in U.S.
- Wildlife Oriented Public Access a main goal
- Trails focused near ponds specifically
- Impact to wintering ducks?

BACKGROUND

San Francisco Bay Region: "Continental Significance" to waterfowl
(North American Waterfowl Management Plan)

Salt Ponds of South Bay: Support up to 27% of Bay's population
(Takekawa et al. 2000)

Photo by C. Robinson

BACKGROUND

Migratory ducks use salt ponds for wintering

Energy reserves impact reproductive success (Ankney and MacInnes 1978)

Possibility: Repeated disturbance = lost foraging time (Yasue 2006, Goss-Custard et al. 2006)

Photo by C. Robinson

OBJECTIVE

- Balance wildlife / recreationist needs
- "Restrictions that promote coexistence"
  (Knight and Temple 1995)
- Data is necessary
- Objective: assess effects of trail use, explore management strategies

Photo by S. Sprang

STUDY HYPOTHESES

1. a.) Abundance and Diversity of ducks located at various distances from a trail do not change significantly in response to trail use.

   b.) Response to trail use by distance is not affected by pond, tide level, time of day, year, or by presence of hunting in nearby ponds.

Photo by C. Robinson

STUDY HYPOTHESES

2. As trail users walk along the trail, ducks encountered at the end of the trail are not located at a significantly larger distance from the trail than ducks encountered at the beginning of the trail.

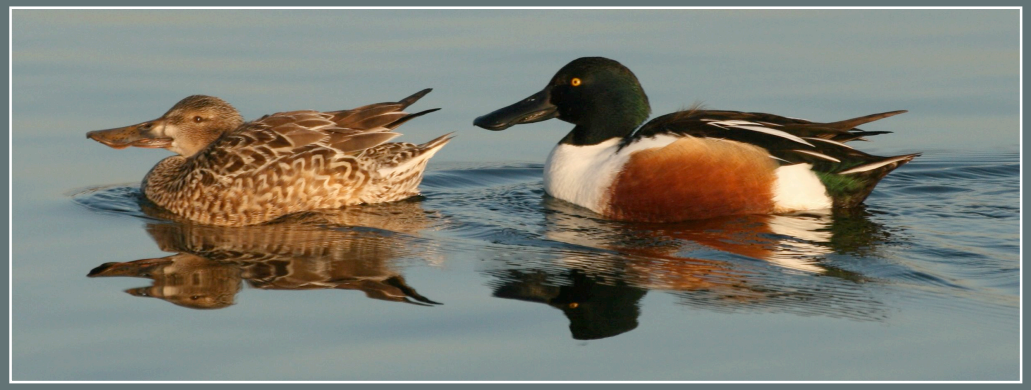


Photo by C. Robinson

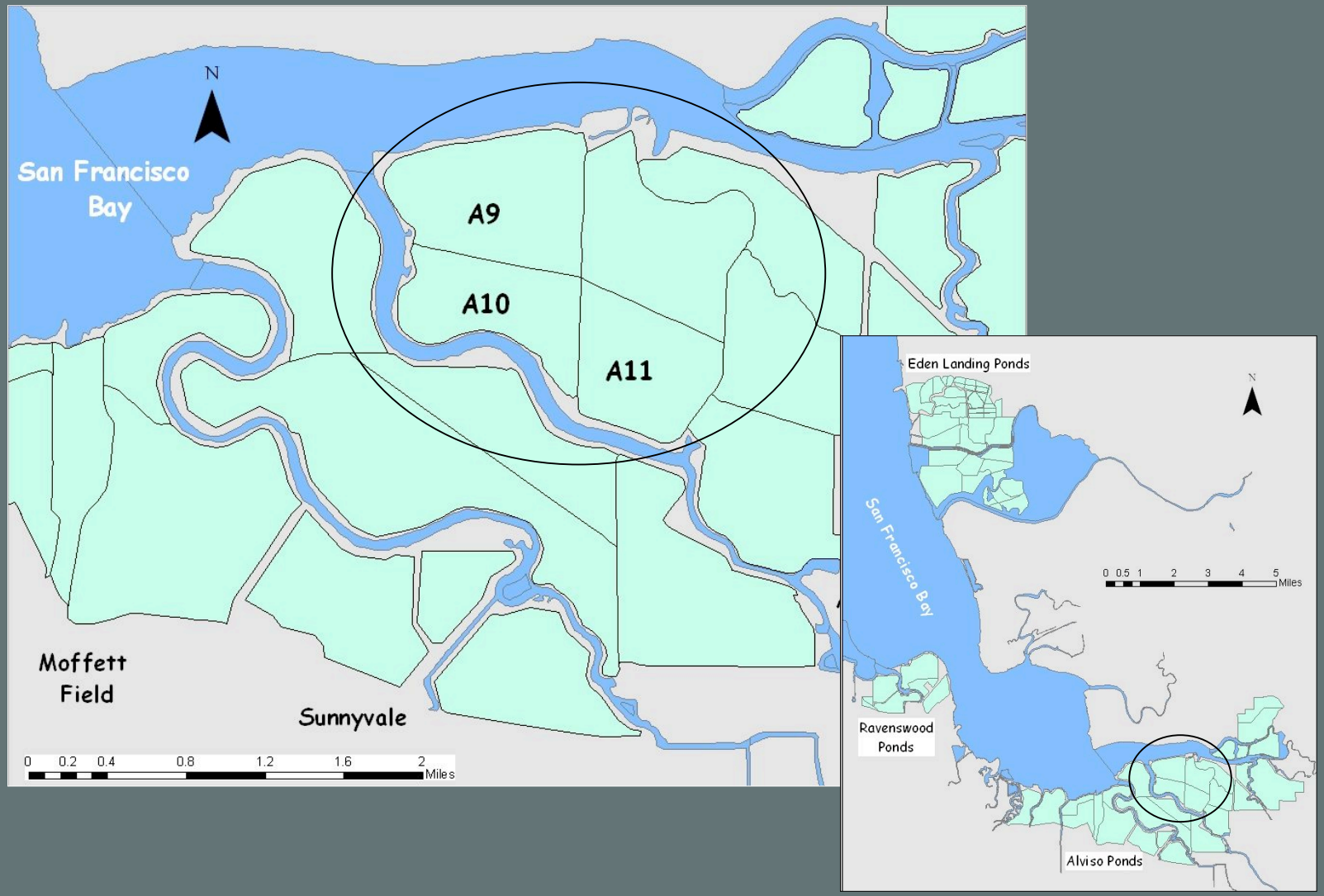
STUDY QUESTIONS

1. How far away from the trail do different species move during the disturbance?

2. What percentage of wintering duck habitat would be affected should all proposed SBSPRP Phase 1 trails adjacent to waterfowl habitat be put into use?

Photo by C. Robinson

STUDY SITE


N
San Francisco Bay
A9
A10
A11
Moffett Field
Sunnyvale
0 0.2 0.4 0.8 1.2 1.6 2 Miles
Eden Landing Ponds
N
San Francisco Bay
0 0.5 1 2 3 4 5 Miles
Ravenswood Ponds
Alviso Ponds

STUDY SITE

Photos by S. Sprang

STUDY DESIGN

Two types of data collection:

- Before/After Counts (before & after disturbance)
- Point Counts (during disturbance)

Photo by S. Sprang

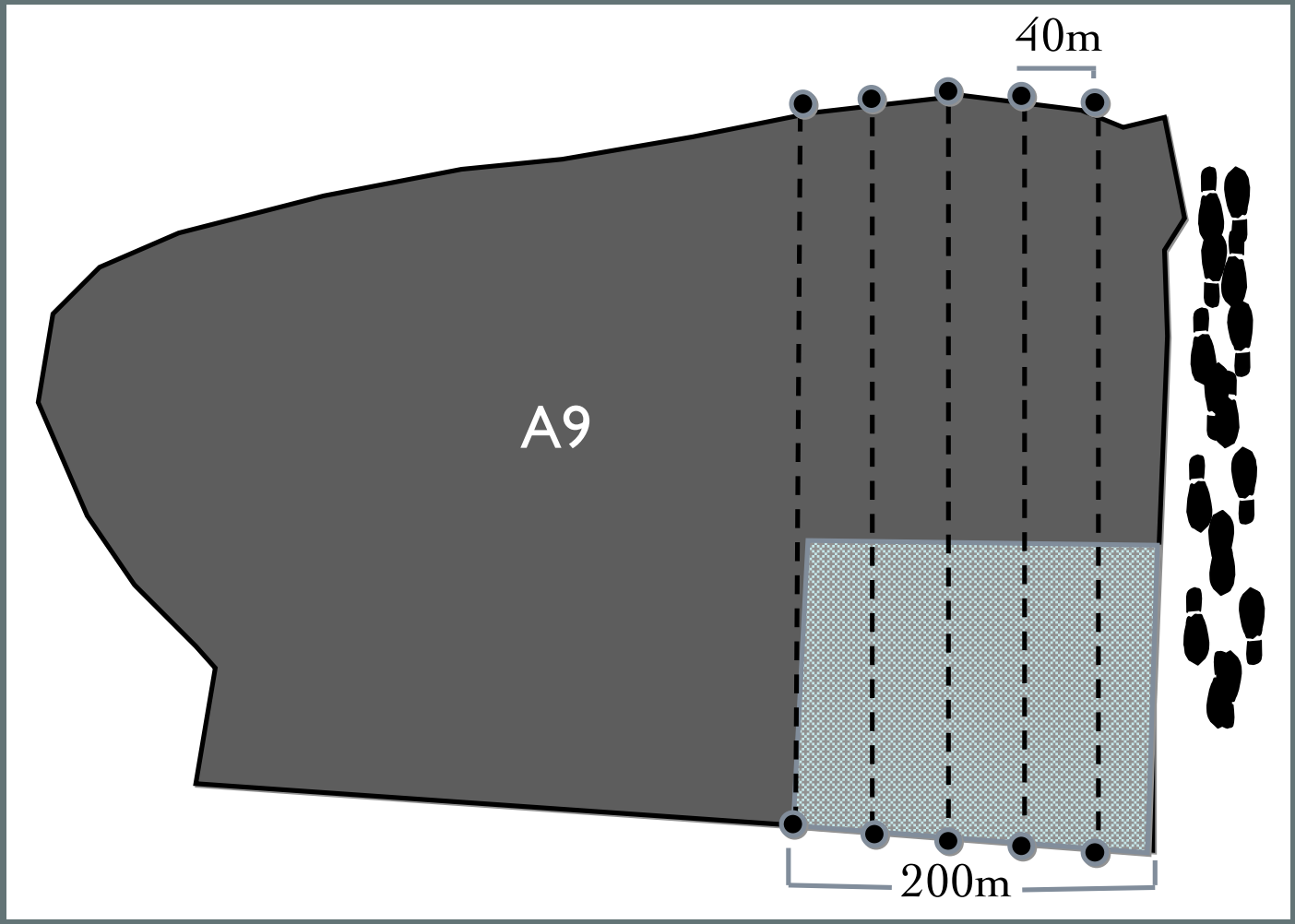
STUDY DESIGN

Before/After Disturbance

Photos by S. Sprang

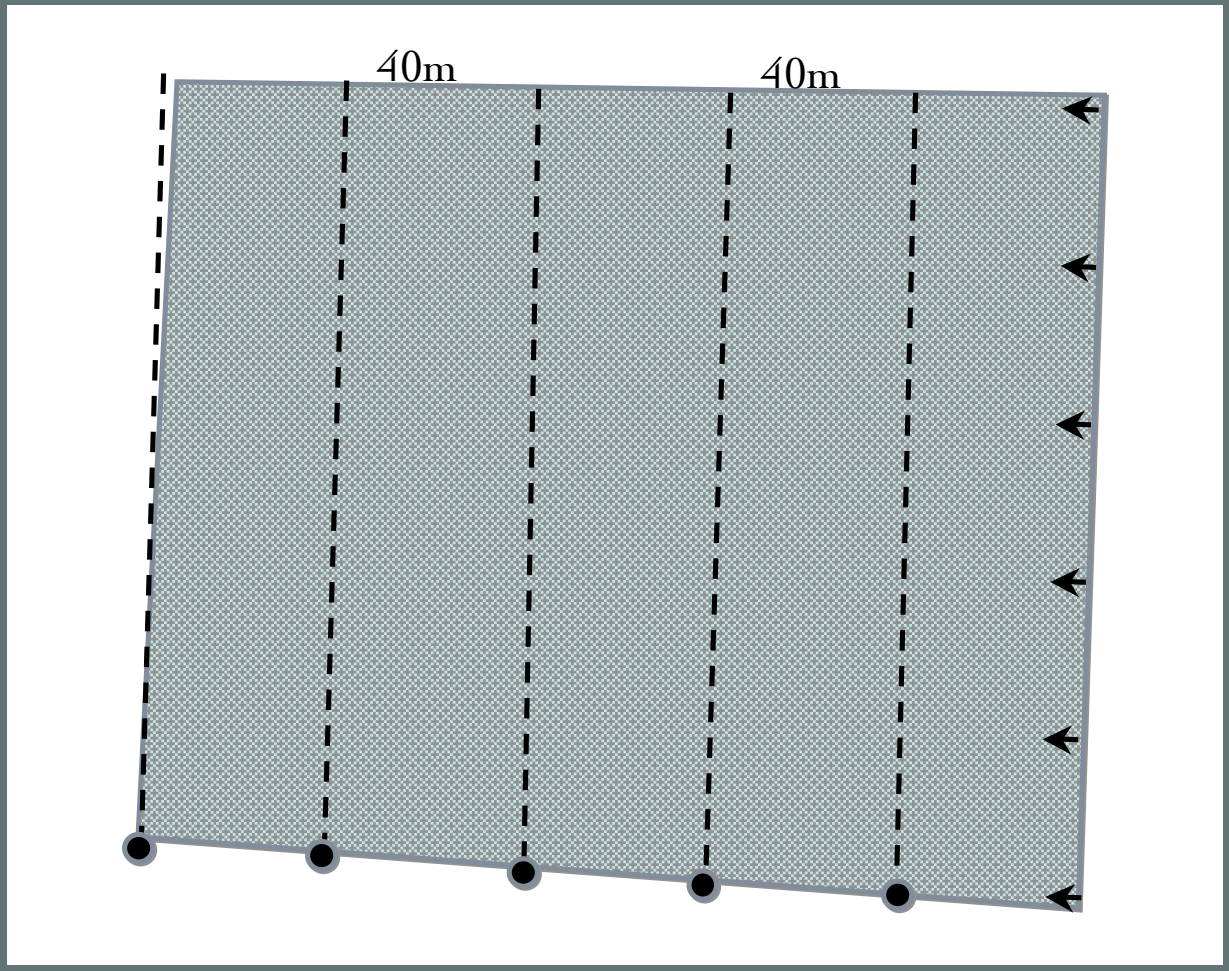
STUDY DESIGN

Before/After Disturbance



STUDY DESIGN

Point Counts (During Disturbance)



DATA COLLECTION

- December 2006 - March 2007 & October 2007-January 2008
- 31 Trials (- 2 interrupted) = 29 Total

Photo by S. Sprang

DATA ANALYSIS

- Hypothesis 1 (a. Abundance before / after by band; b. Other factors)
  - Before/After data: General Linear Model
  - Dependent variables: Overall Abundance, Species diversity, Abundance by species.
  - Independent variables: Band, Pond, Tide, Time of Day, Year, Hunting in nearby ponds
- Hypothesis 2 (Cumulative disturbance effect)
  - Point Count data: Repeated Measures Linear Mixed Model

Photo by C. Robinson

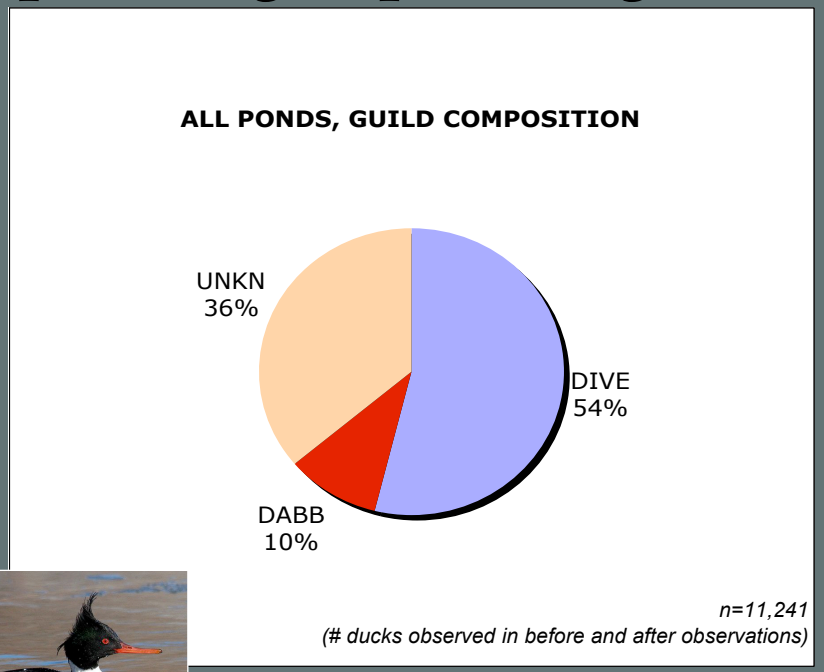
DATA ANALYSIS

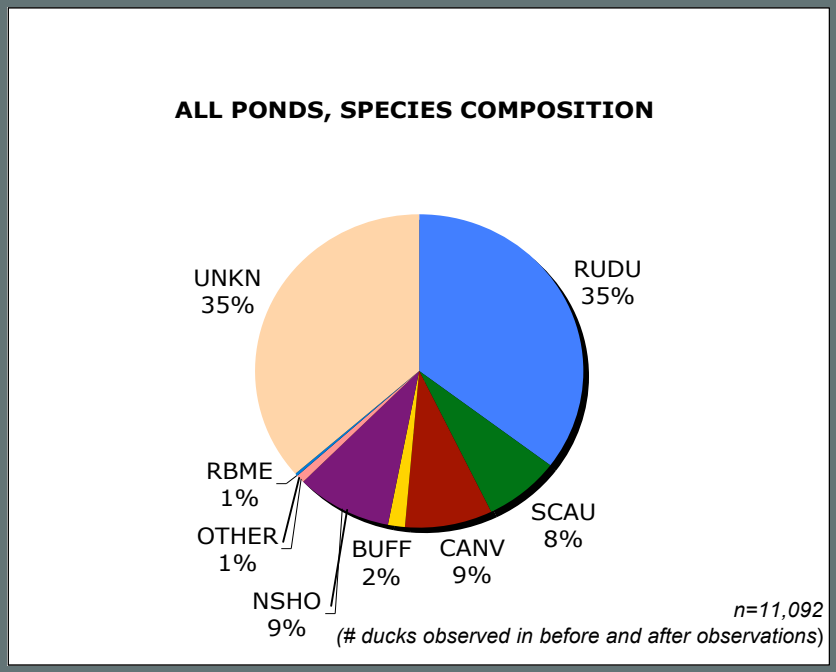
- Study Question 1 (Distance moved during disturbance)
  - Point Count data: Mean distance & SE closest individual by species.
- Study Question 2 (Habitat impact of SBSPRP's Phase 1)
  - Point Count data: Spatial analysis using GIS.
  - GIS data provided by San Francisco Bay Bird Observatory, EDAW Environmental Consulting, and U.S. Geological Survey

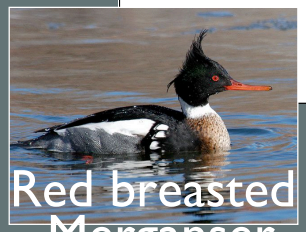
Photo by S. Sprang

RESULTS

Most ducks in trials were divers with Ruddy Ducks making up the largest percentage of the divers.






Red breasted Merganser

northern shoveler

bufflehead

canvasback

greater scaup

ruddy duck

Photos by B. Schmoker

RESULTS

Hypothesis 1a: (Duck abundance before vs. after)

- Significant response seen for Abundance of all species combined, Abundance of Canvasback, and Abundance of Scaup species.

Hypothesis 1b: (Other factors' impact)

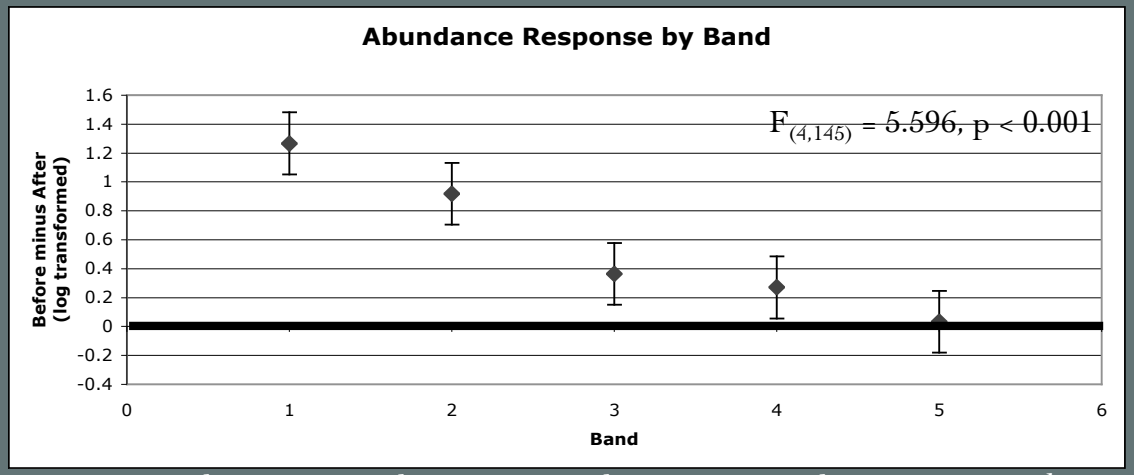
- None of the other factors tested significantly impacted the ducks' response by distance band.

Photo by C. Robinson

RESULTS: ALL ABUNDANCE

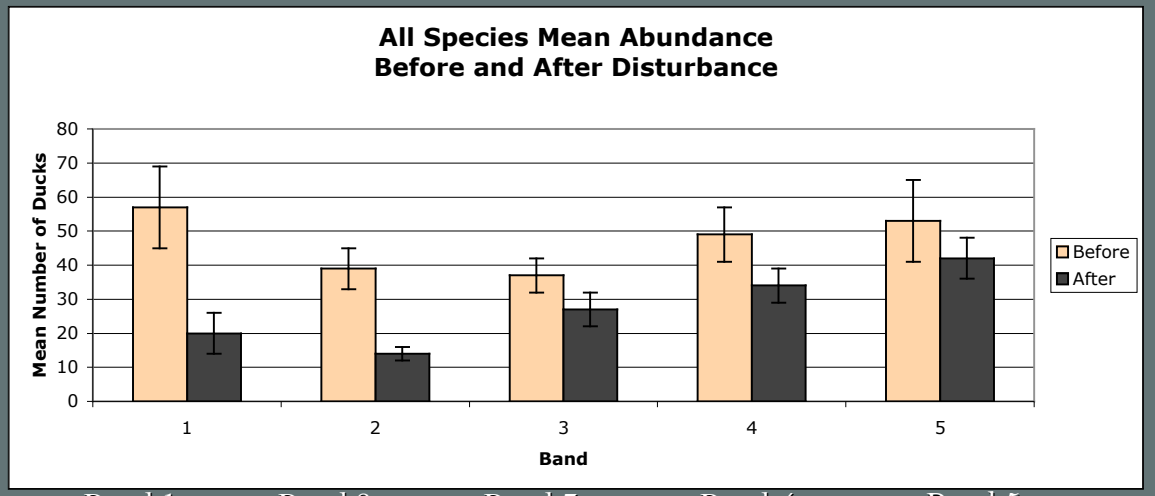
$H_{1a.}$ Before vs. After Disturbance: All species combined

Significant band effect



Band 1= 0-40m | Band 2= 40-80m | Band 3= 80-120m | Band 4= 120-160m | Band 5= 160-200m

Much larger numbers before disturbance than after up to 80m from trail (mean±SE)



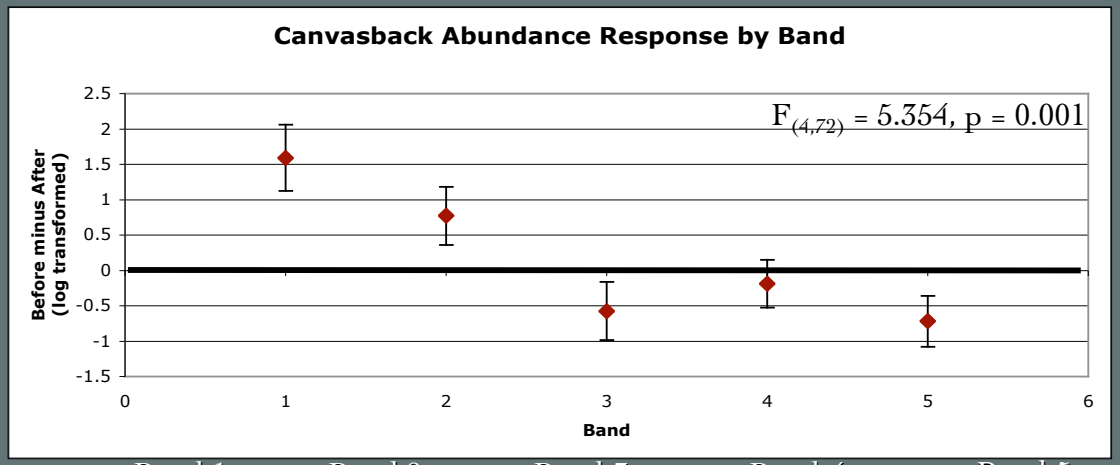
Band 1= 0-40m | Band 2= 40-80m | Band 3= 80-120m | Band 4= 120-160m | Band 5= 160-200m

RESULTS: Canvasback

$H_{1a.}$ Before vs. After Disturbance: Canvasback

Significant band effect

Larger numbers before disturbance than after up to 80m from trail.
Outer bands show more ducks after than before
(mean ± SE)



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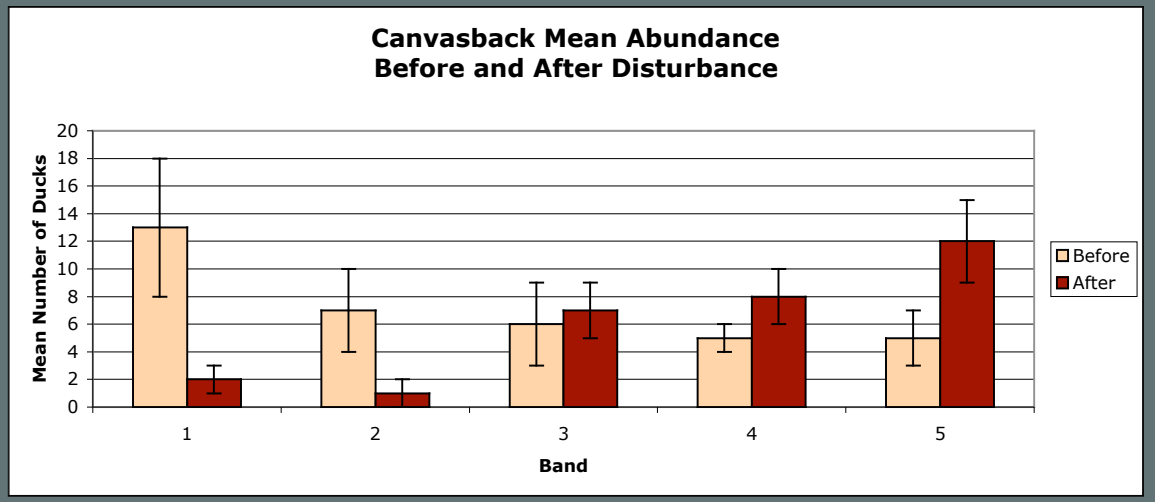


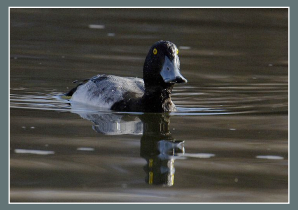
Band 1= 0-40m | Band 2= 40-80m | Band 3= 80-120m | Band 4= 120-160m | Band 5= 160-200m

Photo by B. Schmoker

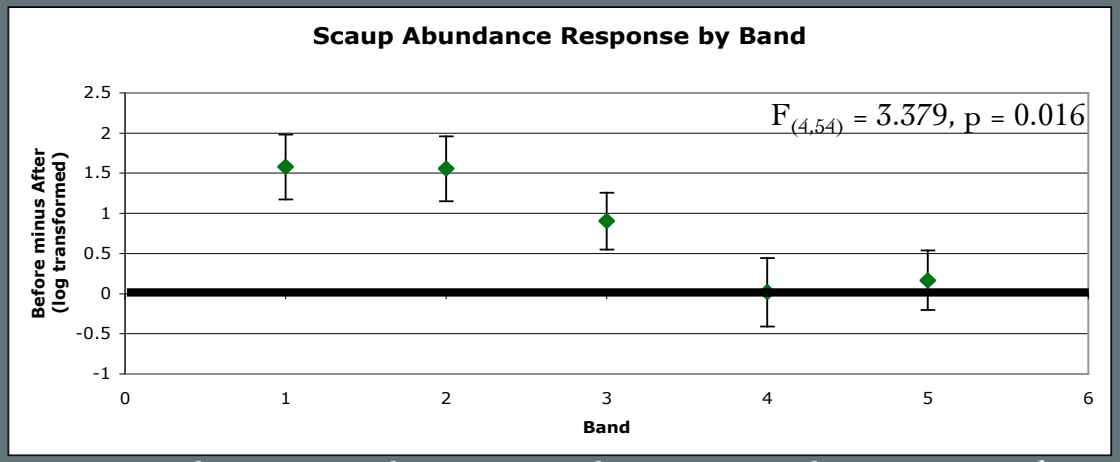
RESULTS: Scaup species

$H_{1a.}$ Before vs. After Disturbance: Scaup species

Significant band effect



Larger numbers before disturbance than after up to 120m from trail.
Outer bands show same numbers of ducks before and after (mean + SE).



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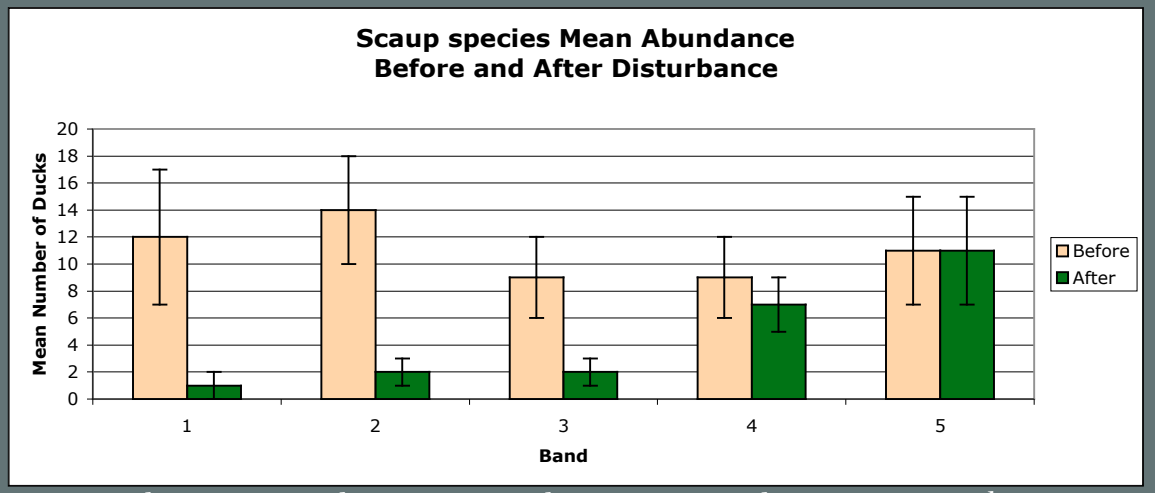


Band 1= 0-40m | Band 2= 40-80m | Band 3= 80-120m | Band 4= 120-160m | Band 5= 160-200m

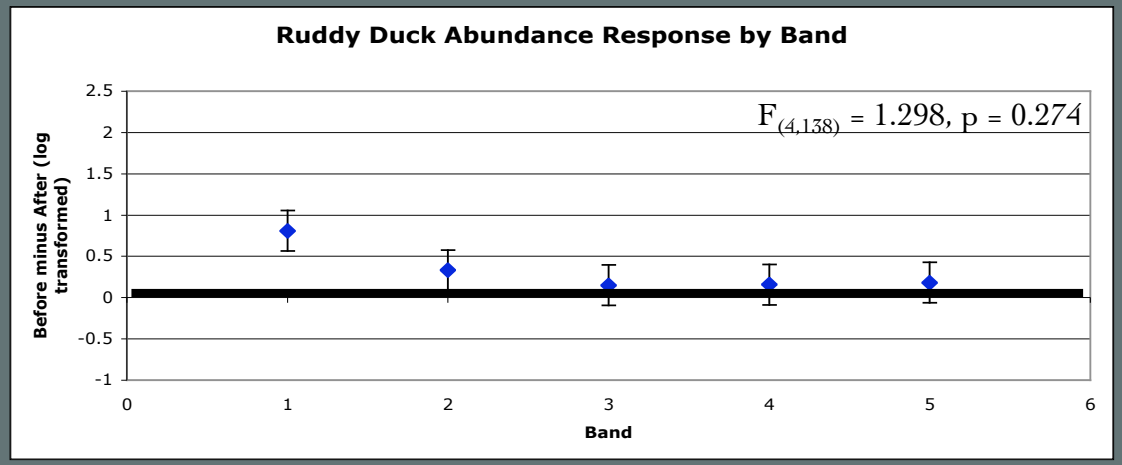
Photo by B. Schmoker

RESULTS: Ruddy Duck

$H_{1a.}$ Before vs. After Disturbance: Ruddy Duck

No significant band effect.

Similar numbers before and after in all bands.



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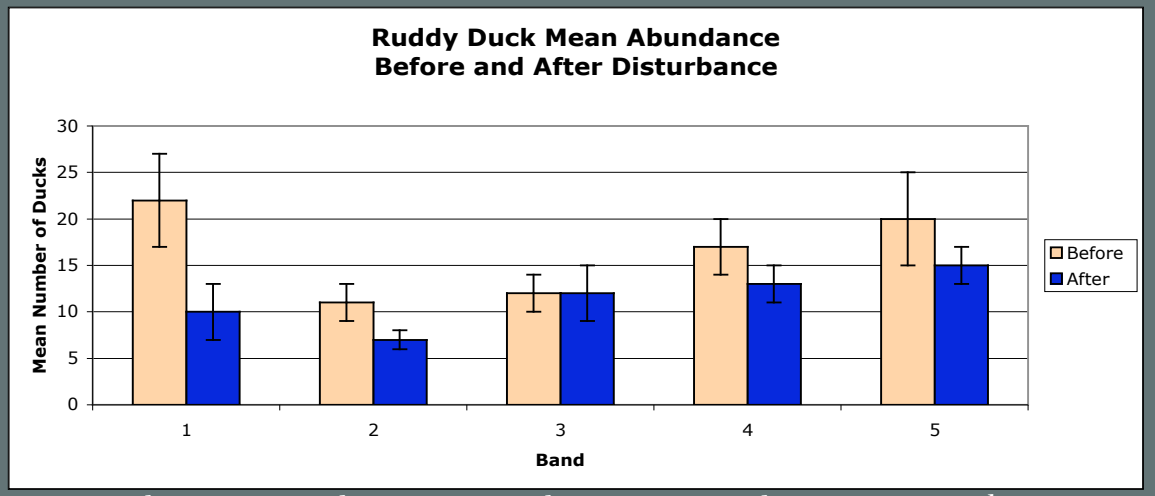
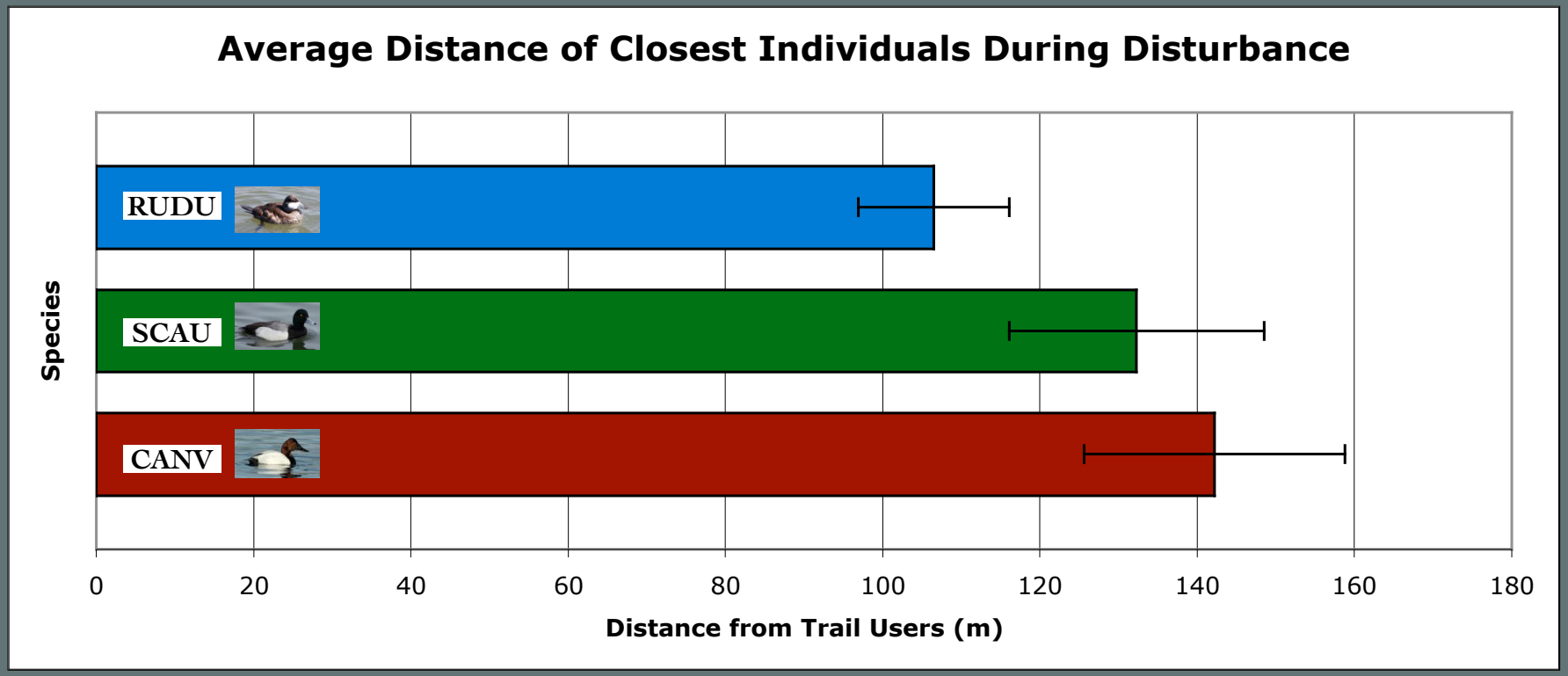


Band 1= 0-40m | Band 2= 40-80m | Band 3= 80-120m | Band 4= 120-160m | Band 5= 160-200m

Photo by C. Robinson

RESULTS

SQ_1. **During disturbance:** Ducks moved considerable distance away from trail users (mean + SE)

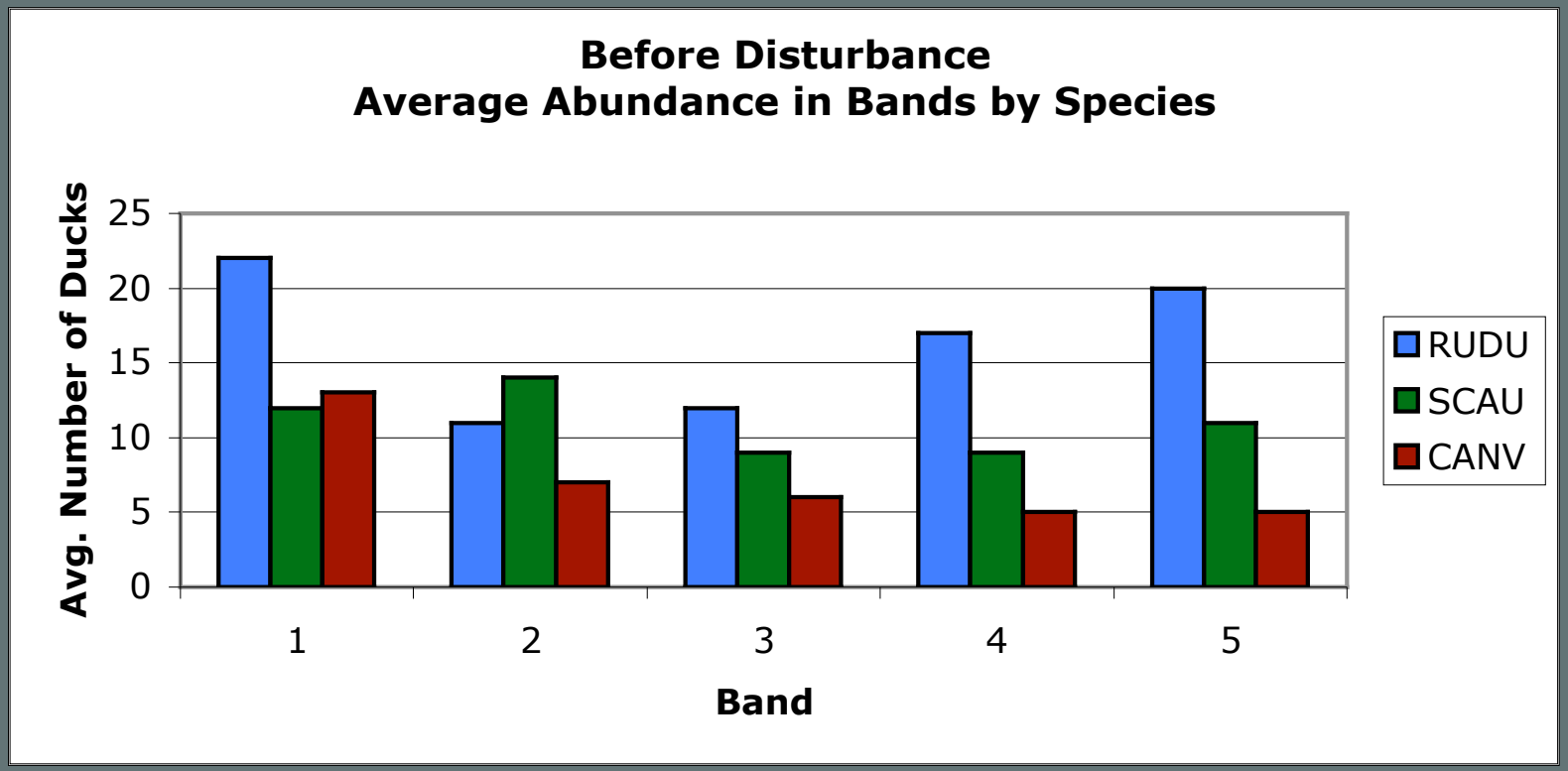


RUDU = Ruddy Duck SCAU = Scaup species CANV = Canvasback

Photos by C. Robinson and B. Schmoker

RESULTS

Before disturbance: Ducks were present in bands closer than 110-140m from trail



Band 1= 0-40m Band 2= 40-80m Band 3= 80-120m Band 4= 120-160m Band 5= 160-200m

RUDU = Ruddy Duck SCAU = Scaup species CANV = Canvasback

RESULTS

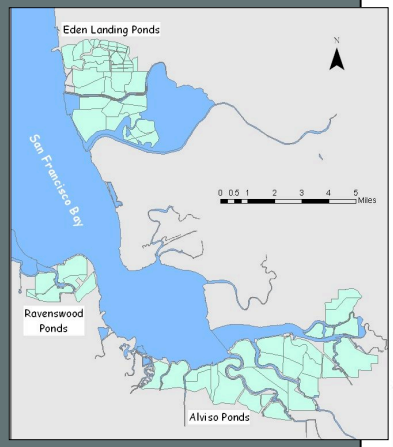
Hypothesis 2: (Cumulative disturbance effect)

- Only Ruddy Duck, Scaup species, and Bufflehead had large enough sample sizes.
- No significant difference between distance responses at points during trail use.

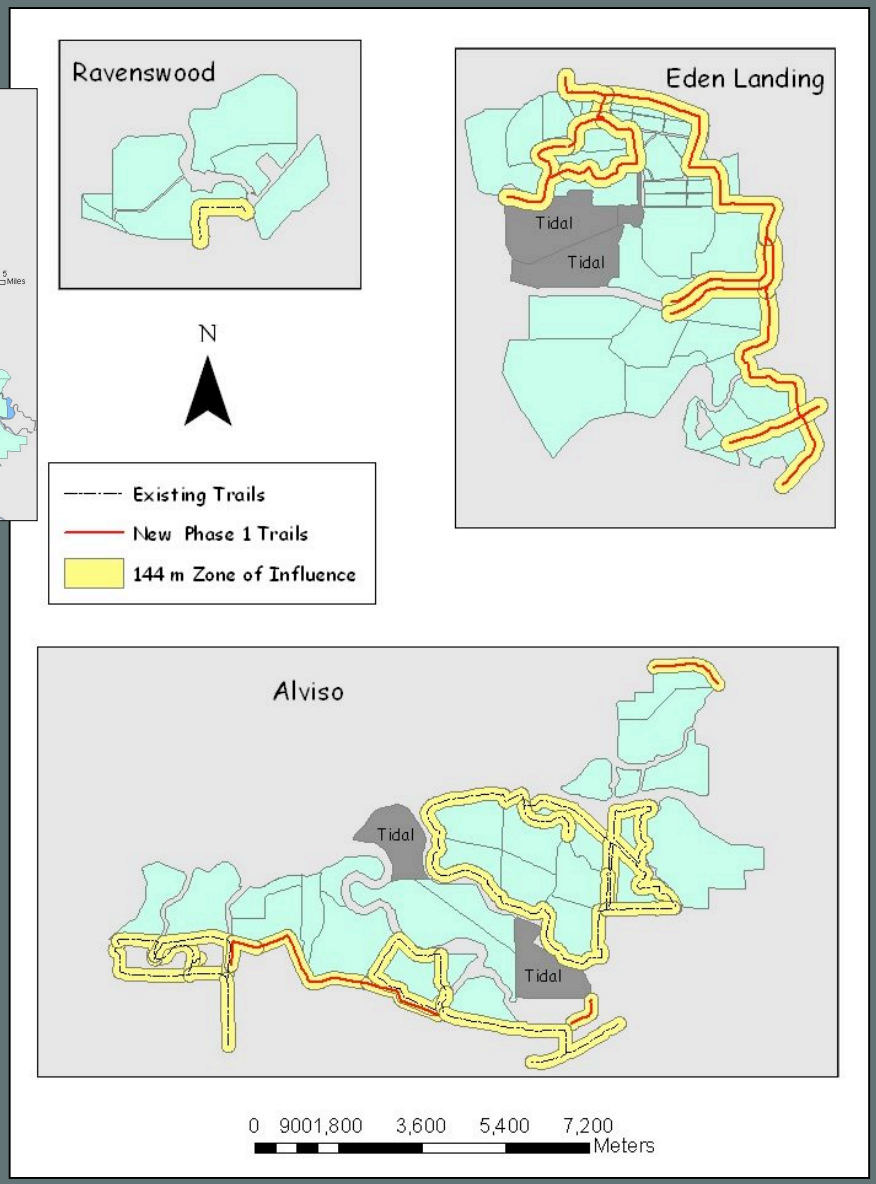
Photo by C. Robinson

RESULTS

SQ_2. Trails' Zones of Influence



- Used Results of SQ1 for zone of influence analysis.
- Averaged distance of closest individuals across 4 most frequently seen species in Point Counts.
- Defined Zone of Influence as this mean + 1 SE = 144m
- Applied 144m buffer to all trails.



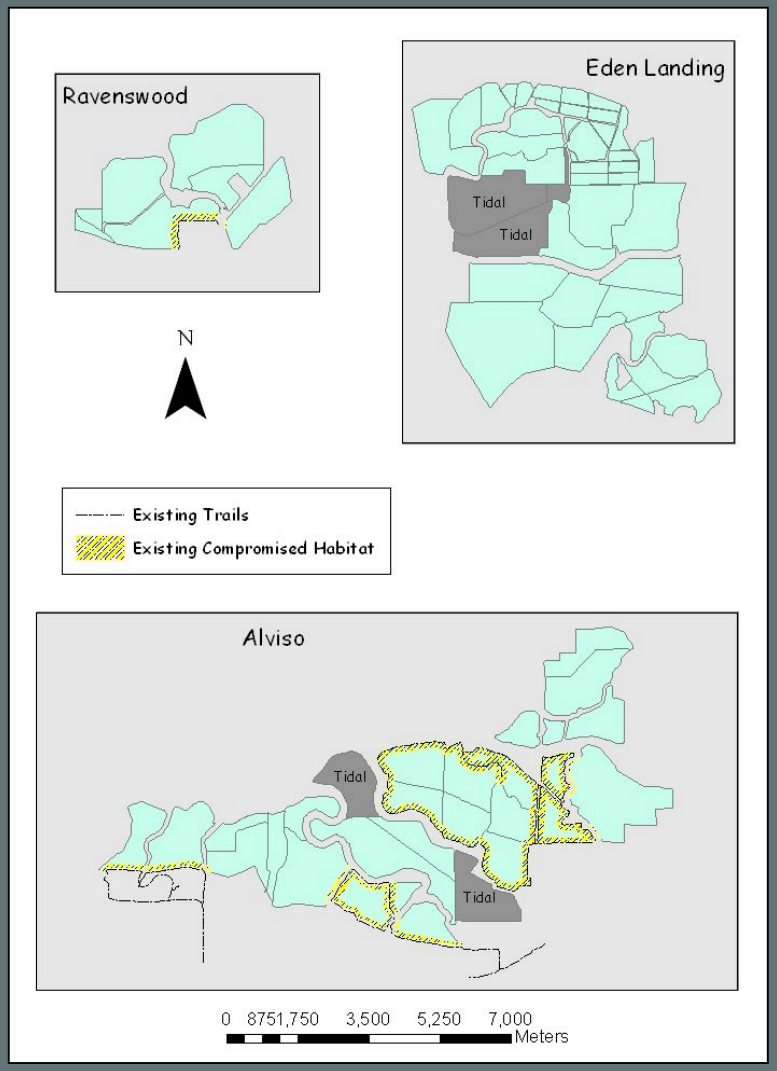
RESULTS

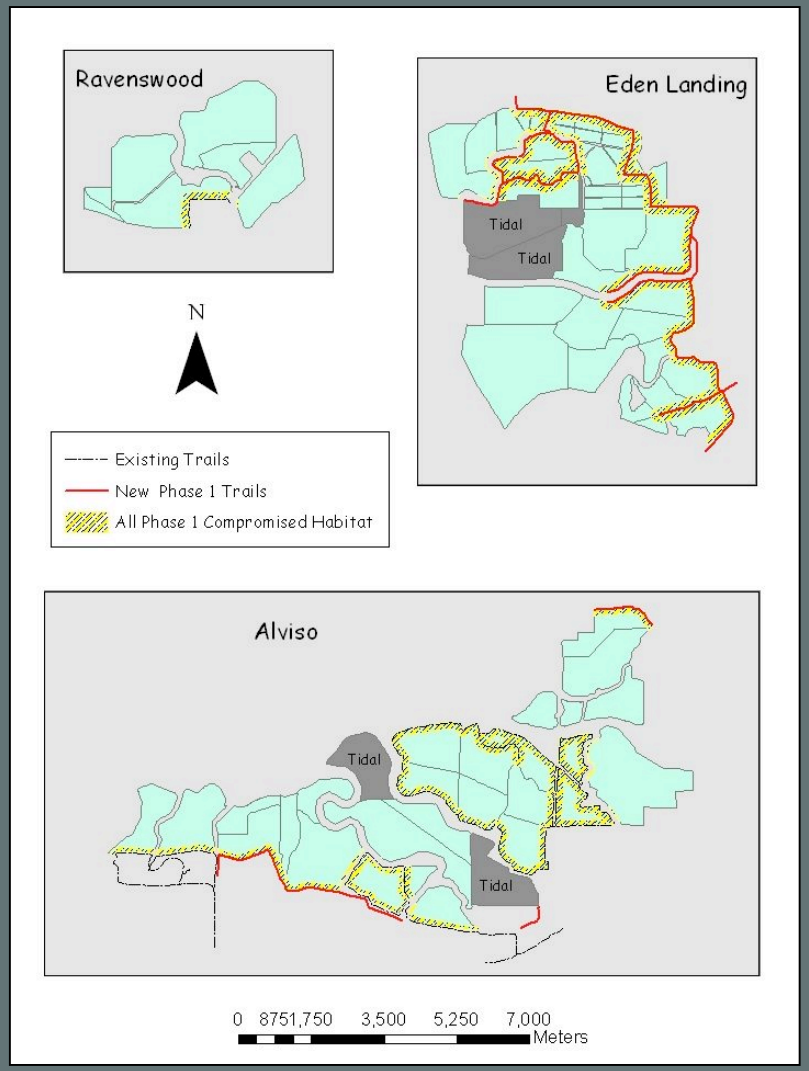
SQ_2. Trail-affected Habitat

Existing Area
476 ha

Increase of
95%

Post-Phase 1 Area
929 ha





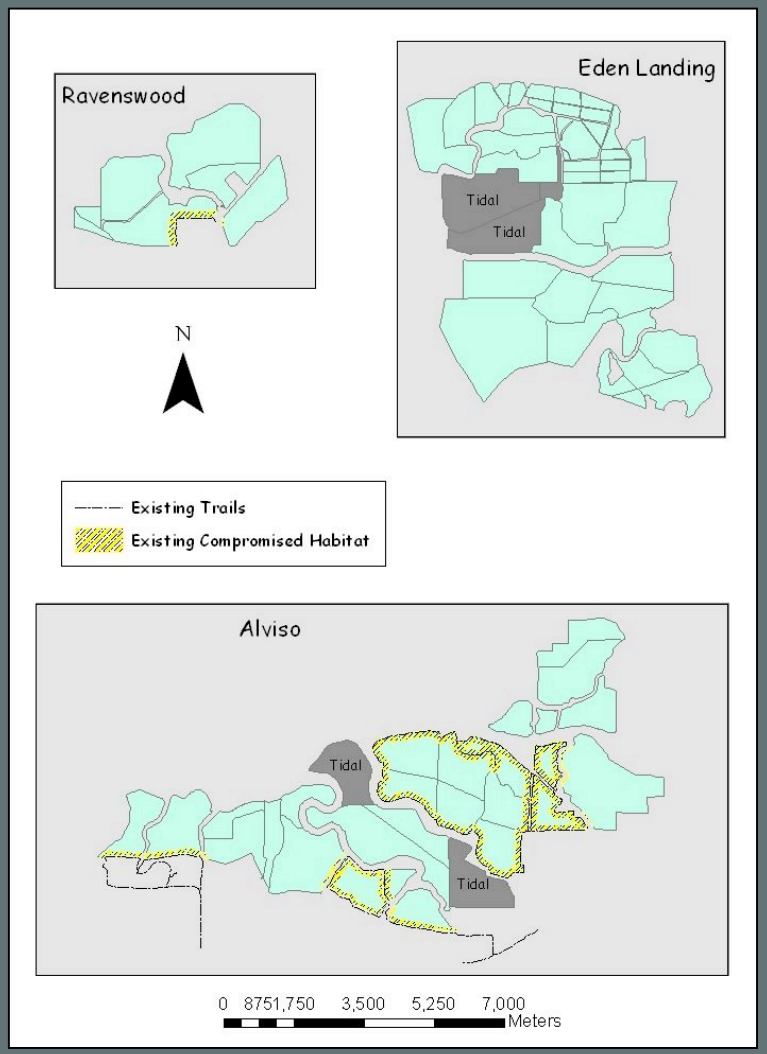
RESULTS

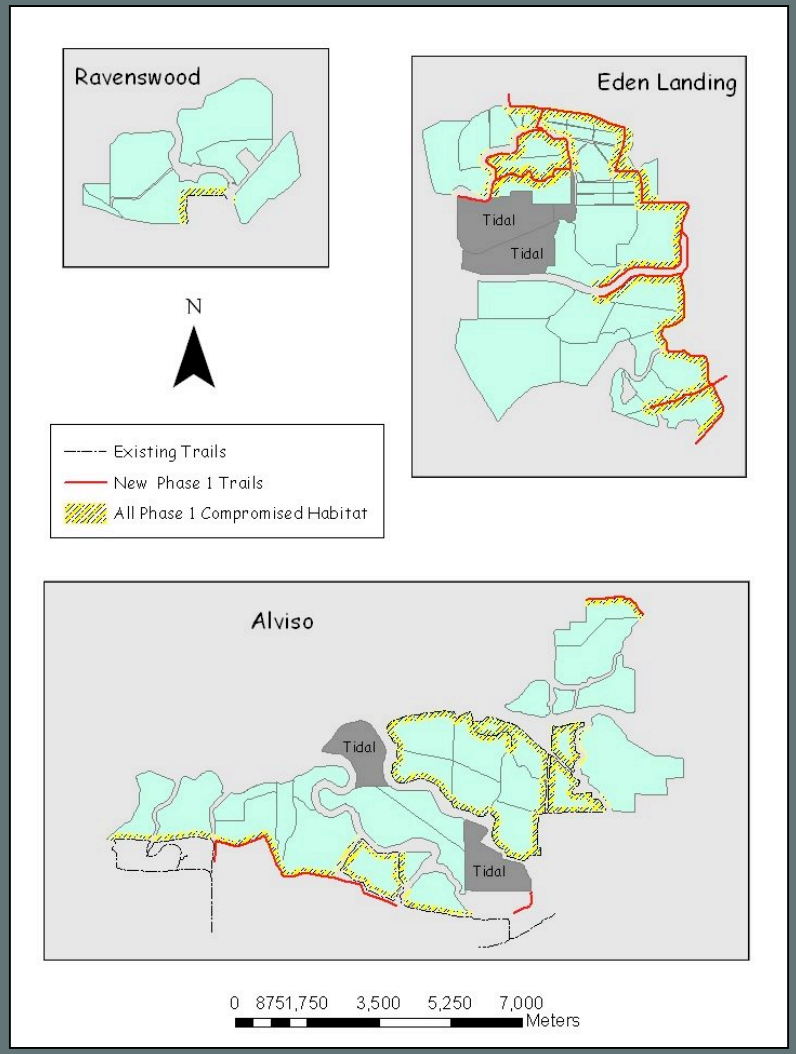
SQ_2. Unaffected Habitat

Existing Area
5389 ha

Decrease of
8.5%

Post-Phase 1 Area
4933 **ha**





RESULTS

Total Project area	6470 ha
Phase 1 Tidal Marsh Conversion	- 605 ha
Current Trail-affected Habitat	- 476 ha
Phase 1 Trail-affected Habitat	- 457 ha
Unaffected Ponded Habitat	**4932 ha**

24% decrease in suitable duck habitat

Photo by C. Robinson

SUMMARY OF FINDINGS

- Wintering ducks, particularly Canvasback and Scaup species, show a clear response to minimal trail use disturbance.
- Distance response to trail use averaged 144m (mean+1SE).
- Phase 1 trail actions will double amount of habitat affected by trail use in project area.
- All SBSPRP Phase 1 actions could decrease suitable duck habitat by as much as 24%.

NEW QUESTIONS

- Will Phase 1 actions actually impact duck population in South Bay?
- How much trail use really occurs in winter here?
- Does habituation play a role?
- Need continued research.

Photo by C. Robinson

MANAGEMENT RECOMMENDATIONS

- If possible, locate trail at least 144m away from pond.
- If location cannot be manipulated, explore other buffer options (i.e. vegetated buffer).
- Enhance non-trail ponds to make up for trail-affected habitat.

Photo by C. Robinson

ACKNOWLEDGEMENTS

- Funders:
  - San Francisco Bay Joint Venture (research grant)
  - San Jose State University (graduate equity fellowship)
- Access to study site:
  - U.S. Fish and Wildlife Service
- Thesis Advisors:
  - Lynne Trulio, Rachel O'Mally, Rick Kos
- Field Assistants:
  - Galli Basson, Li Xuezhi, Caitlin Robinson, Lissa Derugina

QUESTIONS?

Photo by C. Robinson